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ABSTRACT

This activity guide, developed to provide hands-on environmental education activities geared to South Mountains State Park in North Carolina, is targeted for grades 4 and 5 and meets curriculum objectives of the standard course of study established by the North Carolina Department of Public Instruction. Three types of activities are included: pre-visit, on-site, and post-visit. The on-site activity is conducted at the park, while pre- and post-visit activities are designed for the classroom. Major concepts included are: water quality; biotic index; indicator species; metamorphosis; native aquatic species; stewardship of natural resources; watersheds; and natural resource management. Includes a vocabulary list, scheduling worksheet, parental permission form, North Carolina Parks and Recreation program evaluation, and information about South Mountains State Park. (MKR)

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South Mountains State Park

An Environmental Education Learning Experience

Designed for Grades 4-5

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W A T E R

South Mountains State Park

An Environmental Education Learning Experience

Designed for Grades 4-5

"The greatest miracle on this planet is water."

- Loren Eiseley

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CP&L

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was developed by

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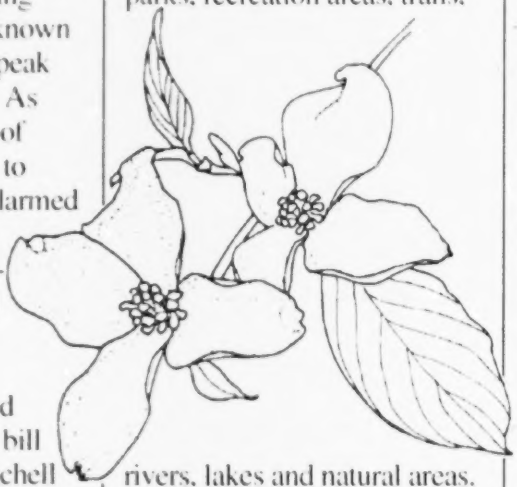
Introduction to the North Carolina State Parks System

Preserving and protecting North Carolina's natural resources is actually a relatively new idea. The seeds of the conservation movement were planted early in the 20th century when citizens were alerted to the devastation of Mount Mitchell. Logging was destroying a well-known landmark - the highest peak east of the Mississippi. As the magnificent forests of this mile-high peak fell to the lumbermen's axe, alarmed citizens began to voice their objections. Governor Locke Craig joined them in their efforts to save Mount Mitchell. Together they convinced the legislature to pass a bill establishing Mount Mitchell as the first state park.

That was in 1915. The North Carolina State Parks System has now been established for more than three quarters of a century. What started out as one small plot of public land has grown into 59 properties across the state, including parks, recreation areas, trails, rivers, lakes and natural areas. This vast network of land boasts some of the most beautiful scenery in the world and offers endless recreation opportunities. But our state parks system offers much more than scenery and recreation. Our lands and waters contain unique and valuable archaeological, geological and biological resources that are important parts of our natural heritage.



As one of North Carolina's principal conservation agencies, the Division of Parks and Recreation is responsible for the more than 125,000 acres that make up our state parks system. The Division manages these resources for the safe enjoyment of the public and protects and preserves them as a part of the heritage we will pass on to generations to come.

An important component of our stewardship of these lands is education. Through our interpretation and environmental education services, the Division of Parks and Recreation strives to offer enlightening programs which lead to an understanding and appreciation of our natural resources. The goal of our environmental education program is to generate an awareness in all individuals which cultivates responsible stewardship of the earth.

For more information contact:

N.C. Division of Parks and Recreation
P.O. Box 27687
Raleigh, NC 27611-7687
919/ 733-4181

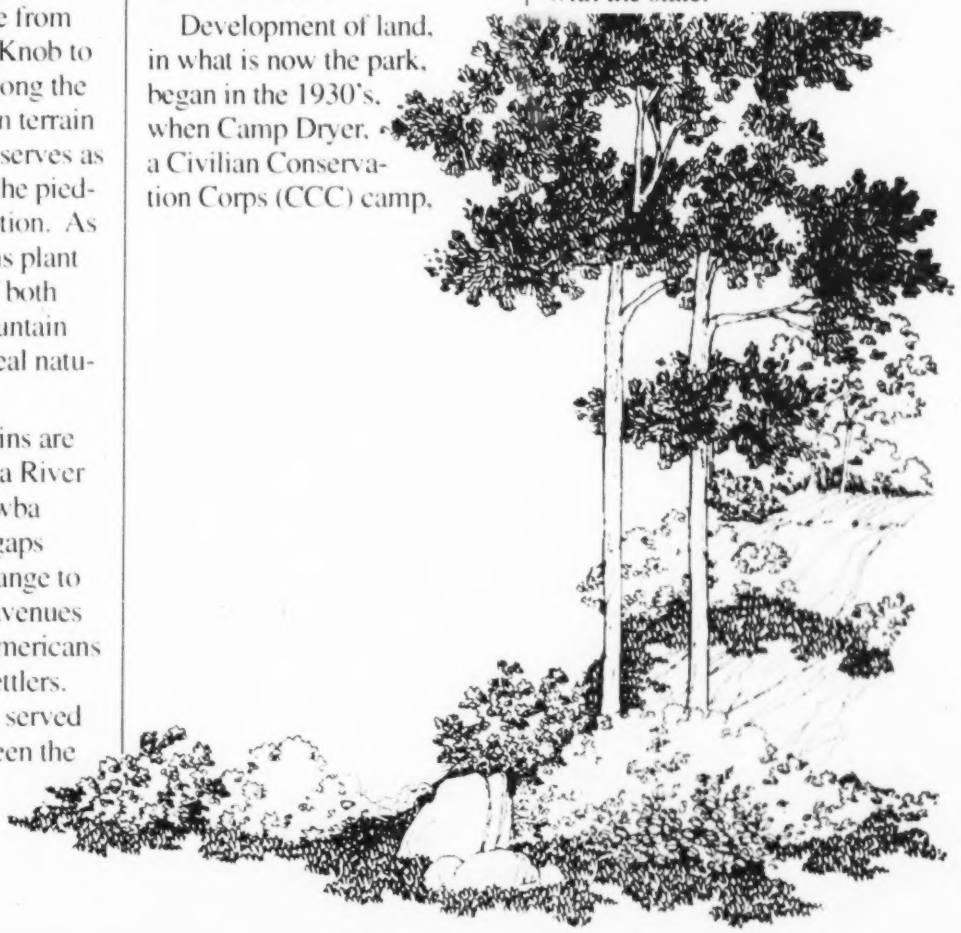
Introduction to South Mountains State Park

South Mountains State Park, located in southern Burke County, is nestled in the beautiful 109,000 acre South Mountains range. Isolated from the more prominent Blue Ridge range to the northwest, the South Mountains range rises from the piedmont plateau to an altitude of 2,980 feet at Buzzard's Roost, the tallest peak in the range. The park itself is characterized by relatively steep terrain with narrow ridge tops and valleys. Slopes frequently exceed 60% with very little flat ground. Elevations in the park range from 2,894 feet on Benn's Knob to less than 1,250 feet along the Jacob's Fork River. In terrain and biology, the park serves as a perfect example of the piedmont-mountain transition. As such, the park contains plant and animal species of both the piedmont and mountain regions, making it a real natural history treasure.

The South Mountains are located in the Catawba River watershed. The Catawba River Valley and the gaps across the mountain range to the west were major avenues of travel for Native Americans and early European settlers. The South Mountains served as a buffer zone between the Cherokee and the Catawba Indians. The first permanent settlements in the area were along the fertile river bottomlands. In 1828, gold was discovered at Brindle Creek in the South Mountains. According to legend, gold grains and flakes were first discovered in the mud used to seal a log cabin. The ensuing gold rush attracted immigrants, mining companies and slave owners to the area. Gold was mined into the twentieth century when the productivity of the mines declined.

Development of land, in what is now the park, began in the 1930's, when Camp Dryer, a Civilian Conservation Corps (CCC) camp, was established at Enola. The youths employed at the camp constructed forest service roads, cleaned stream beds and built a forest observation tower on Horse Ridge. Although the tower no longer exists, the Lower CCC Road and Upper CCC Road are still in use at the park today.

South Mountains State Park was established in December of 1974, as a result of recommendations made by a National Park Service study conducted in coordination with the state.



The Park as an Outdoor Classroom

South Mountains State Park abounds with natural history and is an excellent place to teach ecology, environmental issues, biology, geology, conservation, earth science, literature, math, geology and recreation. The park is rich with cultural resources as well, and provides a wonderful outdoor classroom for learning about the history of Native Americans, European migrants, and many other historical themes. The park's major theme is water quality, which is one of the concepts of this Environmental Education Learning Experience (EELE). This activity packet is hands-on and curriculum-based, and offers an opportunity for students to study and learn about this and many other subjects.

Groups are encouraged to visit the park during all seasons of the year for hikes, exploration, nature study and other activities. Leaders may choose to design and conduct their own activities or make use of the park's environmental education activity packets. A ranger will be happy to welcome your group and answer any questions the students may have, or present a short talk. Park staff will make every effort to accommodate persons with disabilities.

Park Facilities

The park has numerous facilities available for visitors.

Restrooms: Restrooms with running water and acess for persons with physical disabilities are available at the Jacob's Fork Picnic Area.

Picnic Areas: The Jacob's Fork Picnic Area is located adjacent to the main parking area. This area contains twelve tables and nine grills and is accessible to persons with disabilities. The Shinny Creek Picnic area is located 0.4 mile from the main parking area. Four tables, three grills and a pit toilet are provided here.

Backpack Camping: Camping is available to the backpacker in any of four areas: above the High Shoals Falls (sites 1 - 4), near the third bridge crossing on Shinny Creek (sites 5 - 8), on Fox Trail (sites 9 - 11), and on Sawtooth Trail (sites 12 - 14).

Family Camping: A primitive campground with 11 sites lies adjacent to the horse trailer parking area 0.5 mile east of the park office. Each site offers a picnic table and rock fire circle, with two pit toilets available for the entire campground.

Scheduling a Trip

1. Please contact the park one month in advance to schedule an Environmental Education Learning Experience. For other types of programs, including special requests, please contact the park at least two weeks in advance.

2. Complete the scheduling worksheet, located at the back of this activity packet on page 8.1, and return it to the park as soon as possible.

Before the Trip

1. The group leader should visit the park without the participants prior to the group trip. This will help you become familiar with the facilities and park staff and to identify themes and work out any potential problems.

2. The group leader should discuss park rules and behavior expectations with adult leaders and participants. Safety should be stressed.

3. Everyone should wear a name tag. Please color-code tags (for groups) and establish a buddy system.

4. Inform the group about poison ivy, ticks and snakes. You may want to bring insect repellent in the spring and summer.

5. Make sure the students and adult leaders dress appropriately for the season. Comfortable walking shoes and clothes that can get dirty are recommended.

6. The group leader is responsible for parental permission forms, located at the back of this packet on page 8.2, and the group's medical and health needs.

7. If you will be late or need to cancel your trip, notify the park immediately.

8. Research activity permits may be required for activities in which samples are to be taken from the park. Contact the park if research activity permits are needed.

9. Complete the pre-visit activity in the Environmental Education Learning Experience.

While at the Park

Please obey the following rules:

1. Be as quiet as possible while in the park. This will help you get the most out of the experience, while increasing the chance of observing wildlife.

2. On hikes, walk behind the leader at all times. Exercise special care in areas with loose gravel, water bars, exposed roots or steps. Running or jumping is not permitted. Please stay on the trails!

3. All plants and animals are protected within the park. Injuring or removing plants or animals is prohibited in all state parks. Removal of rocks is also prohibited. This allows others in the future to be able to enjoy our natural resources.

4. Picnic only in the designated picnic areas. Help keep the park clean and natural by not littering and by picking up any trash left by others.

5. In case of accidents or emergencies, contact the park staff immediately.

Following the Trip

1. We encourage you to complete the post-visit activity in the Environmental Education Learning Experience.

2. Build upon the field experience and encourage participants to seek answers to questions and problems encountered while at the park.

3. Relate the experience to classroom activities through reports, projects, demonstrations, displays and presentations.

4. Give tests or evaluations, if appropriate, to determine if students have gained the desired information from the experience.

5. Please complete the program evaluation sheet located in the back of the packet, on page 8.3, and send it to the park.

Park Information

South Mountains State Park
Route 1, Box 206-C
Connelly Springs, NC 28612
Tel: (704) 433-4772

Hours of Operation

Nov - Feb	8:00 a.m. - 6:00 p.m.
Mar, Oct	8:00 a.m. - 7:00 p.m.
Apr, May, Sep	8:00 a.m. - 8:00 p.m.
Jun - Aug	8:00 a.m. - 9:00 p.m.

Introduction to the Activity Packet for South Mountains State Park

The Environmental Education Learning Experience "Wild, Wonderful Water" was developed to provide environmental education through a series of hands-on activities geared to South Mountains State Park. This activity packet, designed to be implemented in the 4th and 5th grades, meets established curriculum objectives of the North Carolina Department of Public Instruction. It includes three types of activities:

1) pre-visit activity
2) on-site activity
3) post-visit activity

The on-site activity will be conducted at the park, while pre-visit and post-visit activities are designed for the classroom. The Environmental Education Learning Experience, "Wild, Wonderful Water," will acquaint students with the following major concepts:

- **Water quality**
- **Biotic index**
- **Indicator species**
- **Metamorphosis**
- **Native aquatic species**
- **Stewardship of natural resources**
- **Watersheds**
- **Natural resource management**

The first occurrence of a vocabulary word used in each of these activities is indicated in **bold type**. Definitions are listed in the back of the activity packet. A list of the reference materials used in developing the activities follows the vocabulary list.

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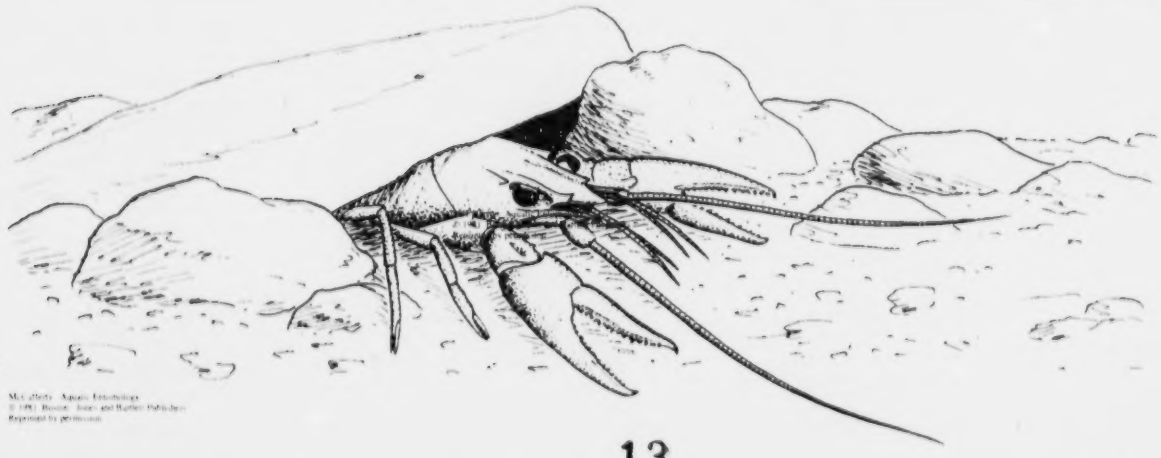
NOTE: On-site activities, weather and river conditions permitting, will be held on the banks of the river and in the river. Students will wade in shallow rocky areas. They should dress appropriately (long pants and tennis shoes) and bring a change of clothing. The students may encounter ticks, poison ivy and snakes, though this is not likely as long as students stay in appropriate areas. Chemical reagents are used in water quality testing. Because misuse of these chemicals can be hazardous, standard chemical protection procedures will be required. Goggles and rubber gloves will be provided for all students handling testing kits. These must be worn at all times during test procedures.

The educator will assist in seeing that all safety precautions are followed. It is also the responsibility of the educator to be aware of special considerations, medical needs, etc. of participants and be prepared to take appropriate precautionary measures. Park staff should be informed of any special considerations prior to the group's arrival at the park.



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Activity Summary

The following outline provides a brief summary of each activity, the major concepts introduced and the objectives met by completion of the activity.

I. Pre-Visit Activity

#1 The Keys to Knowing (page 3.1.1)

Introduce your students to the use of dichotomous identification keys through a series of fun activities. In Part 1, students will use a simple key to identify unknown tree leaves. In Part 2, the students will use a more complex key to identify macroinvertebrates found in the Jacob's Fork River.

Major Concepts:

Part I

- Dichotomous key
- How to use a key
- Importance of keys for identification

Part II

- Basic taxonomy

Objectives:

Part I

- Define dichotomous key and explain why it is used.
- Use a simple key to identify five unknown leaves.

Part II

- Define taxonomy.
- List the five kingdoms.
- Key out at least one macroinvertebrate using a simple key.

Illustration: Aquatic Entomology
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II. On-Site Activity

#1 What's in the Water? (page 4.1.1)

Get wet, have fun, and learn while doing it. Students will use different methods to collect and identify aquatic organisms.

Major Concepts:

- Aquatic habitats
- Aquatic sampling
- Diversity of stream life
- Human influence on water quality
- Indicator species
- Water quality

Objectives:

- Key out and identify three macroinvertebrates.
- Describe three characteristics of an aquatic macroinvertebrate.
- Define indicator species.
- Name three indicator species and explain how they are used to determine water quality.
- Calculate the biotic index.
- Determine the water quality of the Jacob's Fork River.
- List three or more ways humans affect aquatic life.

III. Post-Visit Activity

#1 Caddisfly Creek (page 5.1.1)

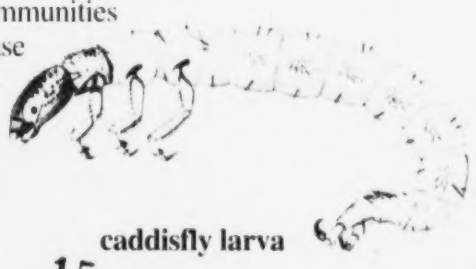
Using a map of the Caddisfly Creek and land use cutouts, students will make decisions about the development of a portion of the river area and the resulting effects of this development on water quality and aquatic life.

Major Concepts:

- Human impact on watersheds
- Water quality
- Land use planning and its effect on a river
- Preservation of natural areas
- Resource management

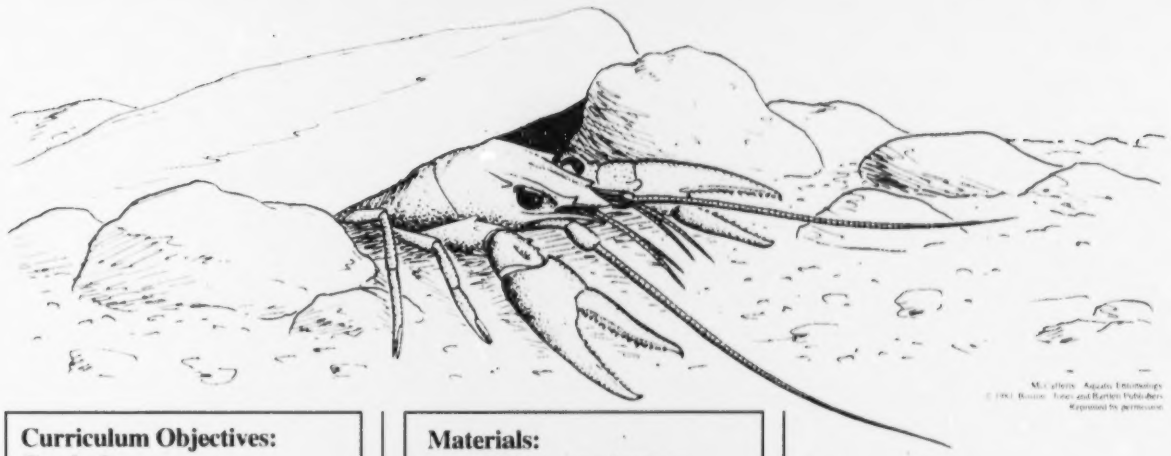
Objectives:

- Evaluate the effects of different imaginary land uses on Caddisfly Creek.
- Discuss and evaluate the effects of three different land use methods on the river.
- List three ways people can change their lifestyles to decrease damaging effects on water quality and on the river.
- List three ways local businesses, industries and communities could change the way they "do business" to decrease damaging effects on water quality and on the river.
- Assess the importance of state parks in protecting the quality of our waters.



caddisfly larva

Pre-Visit Activity #1 — The Keys to Knowing



Curriculum Objectives:

Grade 4

- Communication Skills: listening, reading, vocabulary and viewing comprehension
- Guidance: competency for interacting with others
- Science: living things–animals, adaptation to environment, interdependence of animals
- Social Studies: gather, organize and analyze information, draw conclusions, participate effectively in groups

Grade 5

- Communication Skills: listening and visual comprehension, study skills
- Science: earth science, environment
- Social Studies: gather, organize and analyze information, draw conclusions, participate effectively in groups

Location: Classroom

Group Size:
30 students, class size

Estimated Time:
Part A: 20 - 30 minutes
Part B: 30 - 50 minutes

Appropriate Season: Any

Materials:
Provided by the educator:
Per student: "Key it Out" worksheet, "Key to 10 Common Leaves," pencil
Per group: "Key to Aquatic Macroinvertebrates of the Jacob's Fork River," "Aquatic Life Illustrations," ruler

Educator's Information:

The purpose of this two-part activity is to introduce the use of a simple **dichotomous** identification **key**. Students will learn what a dichotomous key is, why keys are useful and how to use an identification key.

Part I will give students an introduction to the use of a simple leaf identification key. In Part 2, the students will key out several **macroinvertebrates** using the same key they will use in the on-site activity entitled "What's in the Water?"

Major Concepts:

Part I

- Dichotomous key
- How to use a key
- Importance of keys for identification

Part II

- Basic taxonomy

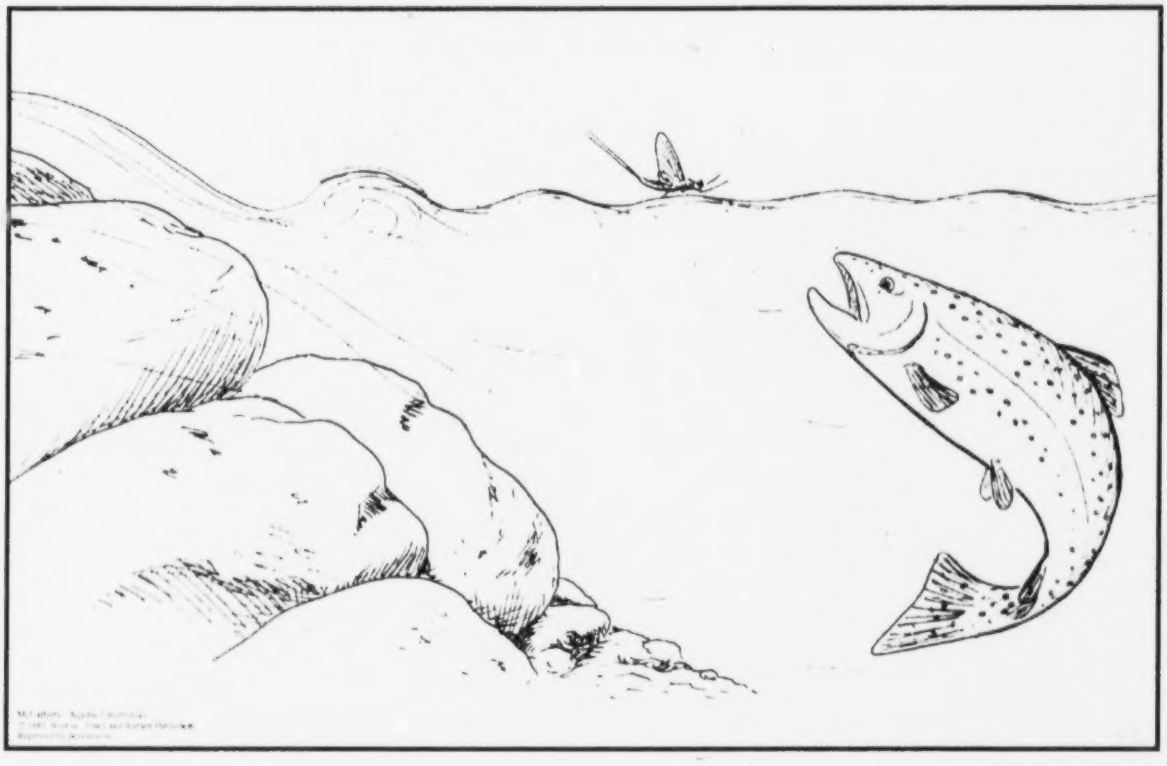
Objectives:

Part I

- Define dichotomous key and explain why it is used.
- Use a simple key to identify five unknown leaves.

Part II

- Define taxonomy.
- List the five kingdoms.
- Key out at least one macroinvertebrate using a simple key.



Instructions for Part I:

Have the students read the Student's Information. Discuss **taxonomy** and how **organisms** are divided into naturally related groups. Define a key and explain how keys work. Discuss why keys are useful. Hand out copies of the "Key to 10 Common Leaves" to each student. Have students work independently through this tree key to identify each of the 10 leaves. As a class, go over the answers and discuss any difficulties encountered.

Instructions for Part II:

Divide the class into groups of four or five. Give each group a copy of "**Aquatic** Life Illustrations" and a copy of "Key To Common Macroinvertebrates of the Jacob's Fork River." As a class, work through the key to identify animal #1, then have the students work within their groups to identify the rest of the macroinvertebrates. When the groups are finished, have each group share how they identified one of the macroinvertebrates. Discuss the difficulties encountered and reinforce the importance of keys.

Suggested Extensions:

1. Divide the class into six groups and give each group a picture of a macroinvertebrate. Instruct each group to identify their organism. Have each group share with the class how they identified it. Rotate pictures until each group has identified all six organisms.

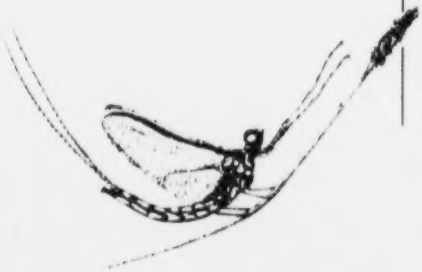
2. Have the students create macroinvertebrate "flash cards" to learn identification.

Student's Information

Taxonomy is the branch of **biology** that deals with the **classification** of **organisms** into established categories. The word, taxonomy, comes from the Greek words meaning arrangement and law. Through taxonomy, organisms are arranged into related groups based on similarities in morphology, **anatomy**, physiology, genetics, **ecology** and **distribution**.

All organisms are divided into large groups known as kingdoms. There are five major kingdoms: 1) Animalia (mammals, **insects**, birds, reptiles, etc.); 2) Plantae (plants); 3) Fungi (mushrooms, molds, yeasts, etc.); 4) Protista (some **algae** and protozoans); and 5) Monera (bacteria and blue-green algae).

These kingdoms are further divided several times into more closely related groups down to a specific organism. For example, let's trace the taxonomic classifications of a dragonfly. Dragonflies belong to the kingdom Animalia. From here they are divided into the phylum Arthropoda which contains all insects and their relatives. Next, they are placed in the class entitled Insecta. In North America alone there are 88,600 species of insects. The class Insecta is further divided into groups called orders. In North America there are 27 orders, each order containing closely related insects. Dragonflies are in the order Odonata. They are further divided up into families, then **genus** and finally **species**. Worldwide, there are about 4,500 species of dragonflies, while in North Carolina there are only 186 species. To know what species we have in North Carolina, we would use an identification key.



Keys:

A **key** is an essential tool used by people studying the science of taxonomy. It is defined as "an ordered list of significant characteristics of a group of organisms used to identify unknown organisms." Simply put, a key is a list of characteristics that describe an organism. Keys are used by scientists and students to identify unknown organisms. Keys often use a combination of pictures and written descriptions to aid in identification. Once you know the name of an organism, then you can look up information about it.

Dichotomous Keys:

Most keys are **dichotomous**, which means dividing or branching into two parts. A dichotomous key, therefore, is a key that divides the characteristics describing an organism into two choices. At each level of the key, you pick the choice that best describes the organism you are trying to identify.

How a Key Works:

Here's how a dichotomous key works. A list of characteristics arranged as a series of either/or statements is used for identifying plants and animals. For each pair of statements, choose the one that best describes the item you're identifying. For example, if you were handed a leaf (from a pine tree) to identify, you would start at the top of the tree identification key with these two choices:

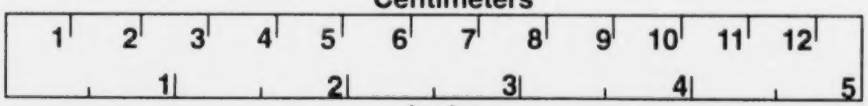
1. Leaves not long or needle-like
2. Leaves long and needle-like

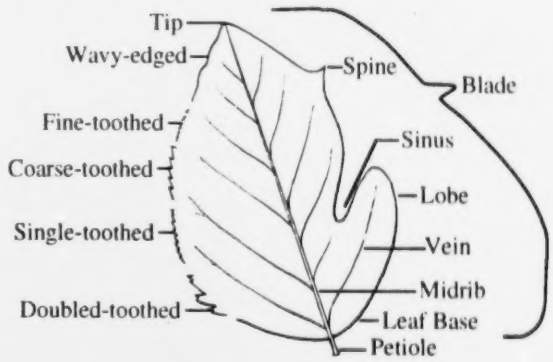
Of course, a pine leaf (or needle) is long and needle-like so you would choose option #2 and continue to the next choice under that side of the dichotomous key.

Key to 10 Common Leaves

(Tree Leaves)

- Leaf long & needle-like
  - Leaves in group of 2; less than 10 cm long — *Shortleaf pine*
  - Leaves in group of 3; more than 10 cm long — *Loblolly pine*
- Leaf not needle-like
  - Leaf with lobes
    - Edge of leaf without teeth
      - Petiole of leaf 1 cm or longer
        - Leaf petiole less than 2 cm — *Sassafras*
        - Leaf petiole longer than 2 cm — *Tulip poplar*
      - Petiole of leaf less than 1 cm — *White oak*
    - Edge of leaf with teeth
      - Leaf with 5 lobes; petiole 3.5 cm or longer — *Sweet gum*
      - Leaf with 3 lobes; petiole shorter than 3.5 cm — *Red maple*
  - Leaf without lobes
    - Leaf edge with teeth
      - Each tooth with spine — *American holly*
      - Teeth without spines — *River birch*
    - Leaf without teeth — *Willow oak*





March 1994

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South Mountains State Park, NC

10 Common Leaves

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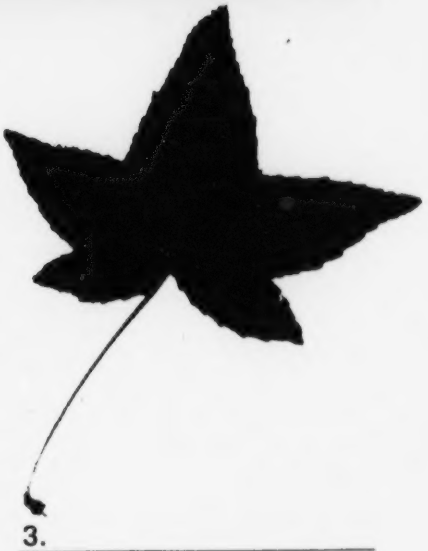
2. _____



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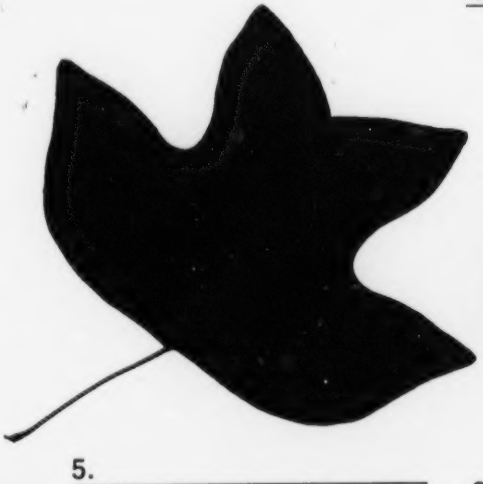

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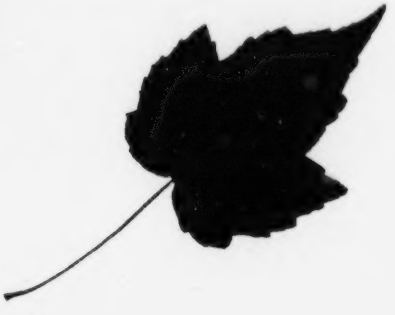

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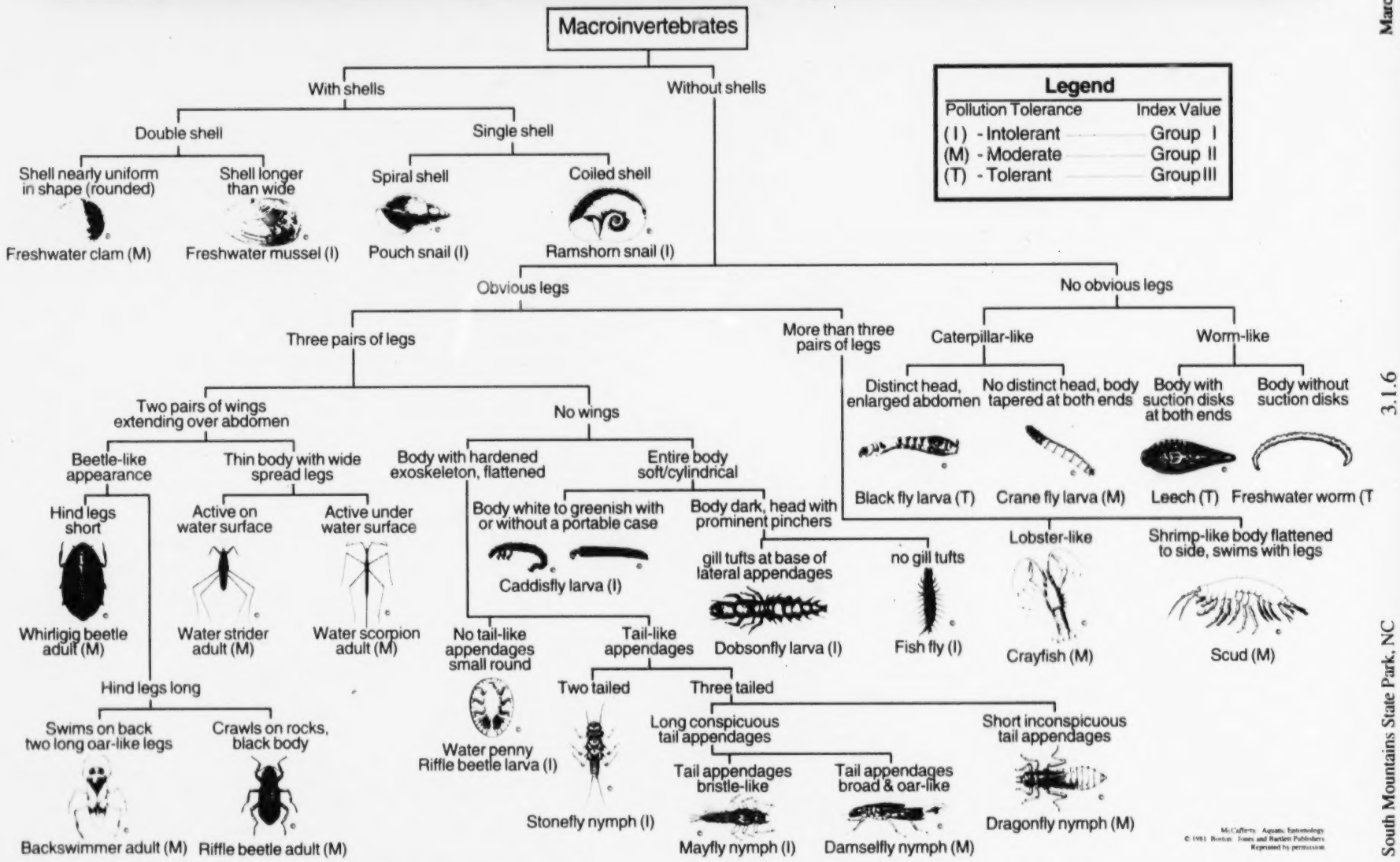
Key To Aquatic Macroinvertebrates
of the Jacob's Fork River



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March 1994

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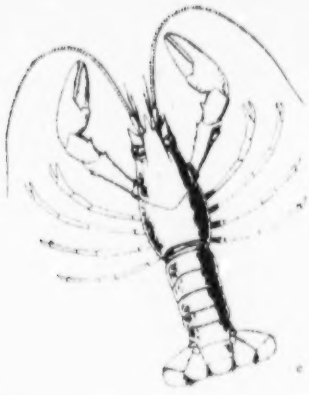
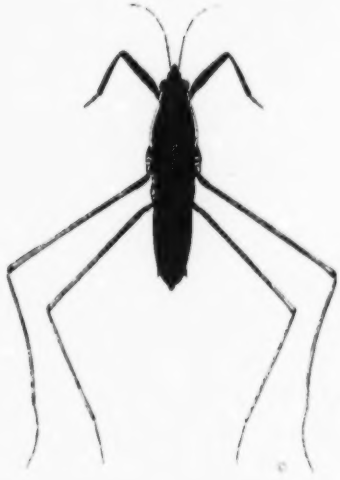
South Mountains State Park, NC

Aquatic Life Illustrations

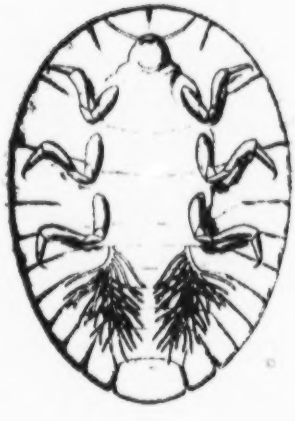


1. _____



2. _____

3. _____



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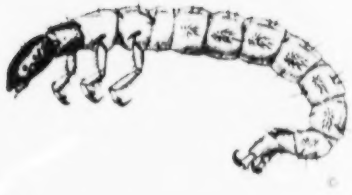

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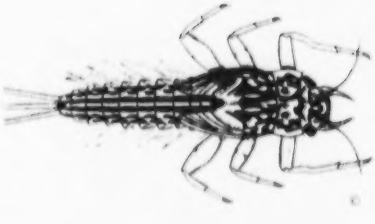

6. _____

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Answer Sheet to 10 Common Leaves

1. *Willow oak*

2. *Sassafras*

3. *Sweet gum*

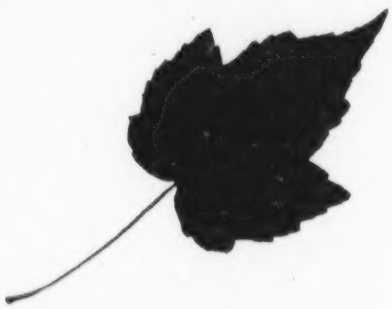
4. *Shortleaf pine*

5. *Tulip poplar*

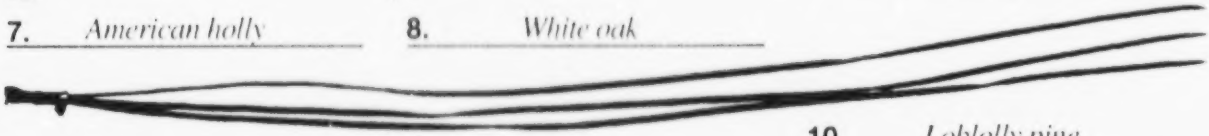
6. *River birch*

7. *American holly*

8. *White oak*

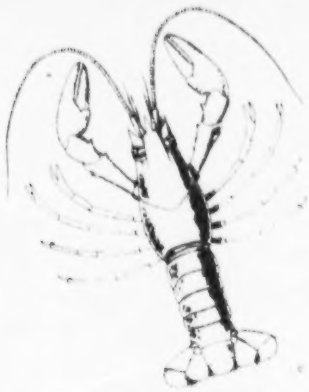


9. *Red maple*

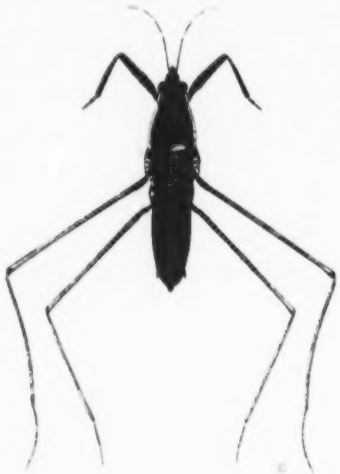


10. *Loblolly pine*

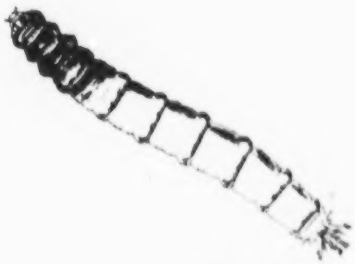
Answer Sheet to Aquatic Life Illustrations



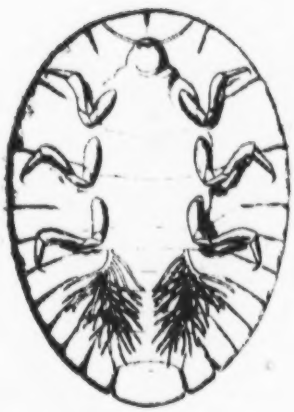
1. *Crayfish*



2. *Water strider*

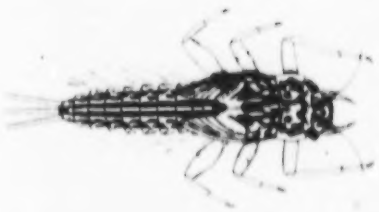


3. *Cranefly larva*



4. *Water penny*

5. *Caddisfly larva*



6. *Mayfly nymph*

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On-Site Activity #1 — What's in the Water?

Curriculum Objectives:
Grade 4
- Communication Skills: listening, reading, vocabulary and viewing comprehension, study skills using environmental sources, writing
- Guidance: group interaction
- Healthful Living: recreational safety
- Science: living things–animals, adaptation to environment, interdependence of animals
- Social Studies: gather, organize and analyze information, draw conclusions, participate effectively in groups

Grade 5
- Communication Skills: listening and visual comprehension
- Guidance: group interaction
- Healthful Living: recreational safety
- Science: earth science, environment
- Social Science: organize and analyze information, draw conclusions, participate effectively in groups

Location:
Jacob's Fork River, Hemlock Nature Trail Access

Group Size:
30 or fewer, in groups of 5 or less

Estimated Time:
1 - 1 1/2 hours

Appropriate Season:
April to October

Credits:
Adapted from "A Field Manual for Water Quality Monitoring, an Environmental Education Program for Schools" by Mark K. Mitchell and William B. Stapp, and Aquatic Project WILD activity, "Water Canaries."

Materials:
Provided by park:
Per student: life jacket, pencil
Per group: kick net, wide mouth plastic jars, aquariums, plastic tubs, dissecting scope, magnifying glass, tweezers, clipboards, field guides to aquatic life, laminated fish keys, laminated invertebrate key, aquarium nets, plastic spoons, examples of adult macroinvertebrates, rubber gloves
Per class: remarkable board, tables, extra activity sheets
Provided by the educator:
Per student: "Key to Common Macroinvertebrates of Jacob's Fork River," "Aquatic Sampling" worksheet, "Pollution Tolerance of Macroinvertebrates" key
Provided by each student: complete change of clothes (wear clothes and shoes that can get wet and/or dirty)

Note: A restroom is located near the activity site where the students can change clothes.

Special Considerations:
Carry a rescue throw rope. Students should wear gloves when sorting samples. Handle organisms carefully so that they can be returned without injury to the water after the activity. Before activity, advise the students of appropriate dress (i.e. old shoes without holes, old jeans, etc.).

Major Concepts:
- Aquatic habitats
- Aquatic sampling
- Diversity of stream life
- Human influence on water quality
- Indicator species
- Water quality

Objectives:
- Key out and identify three macroinvertebrates.
- Describe three characteristics of an aquatic macroinvertebrate.
- Define indicator species.
- Name three indicator species and explain how they are used to determine water quality.
- Calculate the biotic index.
- Determine the water quality of Jacob's Fork River.
- List three or more ways humans affect aquatic life.

Educator's Information:

To prepare your students for their visit, we recommend they read the Student's Information and complete the Pre-Visit Activity, "The Keys to Knowing." Discuss these topics as a class prior to your visit.

In the early days of coal mining, canaries were taken into mines. Canaries are more sensitive than humans to the presence of dangerous gases in the air, therefore their discomfort or death indicated the air was unsafe for the miners to breathe. Although this practice no longer exists, it stands as an example of how animals have differing sensitivities to environmental factors than humans.

In **aquatic** and terrestrial environments, certain **organisms**, called **indicator species**, reveal much about the **quality** of the environment. These creatures comprise a **biotic index**. Their absence or presence tells us something about the environment's quality.

Water **habitats** with a rich and varied range of aquatic creatures are usually "**healthy**" environments, whereas water with just a few species usually indicates conditions that are less "healthy." Healthy is a term used here to indicate an environment that supports a wide variety of living things. **Pollution** reduces the quality of the environment and, in turn, the **diversity** of life forms. In some cases the actual biomass, or amount of living material, will increase due to pollution, but the diversity inevitably goes down.

The major purpose of this activity is to introduce students to **macroinvertebrates** and aquatic organisms and how these can be used as indicator species to determine the health of a river. We expect the students will find the biotic index for the Jacob's Fork River is very high, due to the quality of the water.

The students will be involved in collecting macroinvertebrates from the river and must be dressed appropriately. Life jackets must be worn at all times. A first aid kit will be available. The park staff will rope off an area where the sampling will occur. They will discuss safety considerations and the group leader will assist in seeing that all safety precautions are followed. The students will work in groups of four or five, with one person in each group recording the data.

Have the students start by observing the water. Look for organisms on the surface and underwater. Using the sampling equipment (nets, trays, assorted containers, etc.), students should collect as many different forms of animal life as possible. Ask them to be alert to differing micro habitats located near rocks, in riffles and in eddies. Place the collected animals in the white trays, plastic jars or aquariums for viewing and keying out. The whiteness of the trays allows greater detail to be seen on the animals collected. Keep an adequate amount of water in the trays and place them in a cool, shady spot. Change the water as often as necessary to keep the animals cool and alive.

Have the students use their aquatic macroinvertebrate identification **key** to identify the animals. Have them fill out their worksheets indicating the number of each species found and describing the actual locations where that animal was found, i.e. in pool areas, under rocks, the water's surface, etc. Once these observations and the worksheets are completed, carefully return the animals to their natural habitat.

Note: These animals are protected by park rules and regulations. By exercising care, all the animals can be returned to their home without being harmed.

Encourage the students to discuss their observations. How many different aquatic animals were found? Introduce the concept of diversity of life, and particularly emphasize that a variety of different kinds of plants and animals is usually an indication of a healthy **ecosystem**.

[illegible]

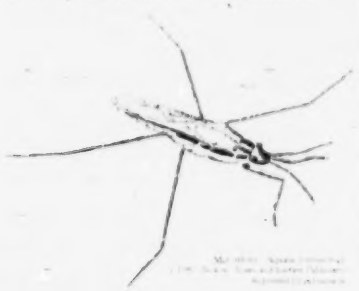
Student's Information

"Water, Water everywhere nor any drop to drink." So says the sailor in Samuel Taylor Coleridge's *Rime of the Ancient Mariner* as his ship is becalmed at sea. Fortunately, in our area **water** is everywhere and there seems to be plenty to drink. But that could change as this area becomes more developed and the water is used by more people. Let's take a closer look at water and discover what a fragile and sensitive resource it is.

What is water?

The dictionary defines water as a colorless, odorless transparent liquid essential for plant and animal life. It is found on earth in rivers, lakes and oceans, and falls from the clouds as rain, snow and ice. Water occupies more than 70 percent of the earth's surface, and it makes up approximately 60 percent of the human body. You may have heard the saying "Water is life." Think about that for a minute. Can you think of any living organism that does not depend on water?

David Quammen, in his book, *Natural Acts, A Sidelong View of Science and Nature* says, "Without life, there would still be water. Without water no life."



Recipe for a River:

Water comes in many forms. To really appreciate it you need to pick out one of its many forms and get to know it personally. For your visit to South Mountains State Park, you need to know more about water in the form of a river.

What is a river?

A river is defined as a large, natural stream of water emptying into an ocean, lake or other body of water and usually fed along its course by converging **tributaries**. The Jacob's Fork River is the largest river in South Mountains State Park. The river is the result of springs, streams and creeks joining together to produce a larger volume of flow. These smaller bodies of water are called tributaries. The land that a river and its tributaries flow through is called a **watershed**. A **healthy** river must have a well protected watershed because any kind of disturbance to the watershed has an effect on the river.

Life in a River:

The various forms of life found in a river can be compared to a fine stew or soup. A fine stew or soup needs lots of different ingredients. Usually the more you add, the better the stew. A stew also needs small amounts of spices to make it taste just right. If you try to make a stew with just one ingredient, or if you leave out an important spice, your stew is not going to be good.

Here then is a recipe for a fine, healthy river.

Some sunlight - just enough for **algae**, moss, diatoms and **aquatic** plants to **photosynthesize**. (Too much sun heats up the water and robs it of **dissolved oxygen**.)

Dissolved oxygen and carbon dioxide - all the animals in the river need dissolved oxygen to breathe. These same animals breathe out carbon dioxide which is essential for algae and other aquatic plants. These plants in turn take in the carbon dioxide and give off oxygen.

Fallen leaves - they provide the main source of food energy in a river system. In the fall, leaves drift down from the trees into the water where they soon sink to the bottom or get caught in logjams or wedged between rocks. At this point, bacteria and fungi climb aboard the leaves and begin to munch out, causing the leaves to decompose and break down into smaller pieces. The half-eaten leaves, along with the decomposers, are eventually swept downstream. They provide food for munchers, grazers and filter feeders – the wonderfully adapted **macroinvertebrates** (macros), such as stonefly **nymphs**, mayfly

nymphs, and caddisfly **larvae**. These **organisms** further break down the leaves into a very fine mulch called **detritus**.

In addition to the munchers, grazers and filter feeders, there are macros that prey on other macros. Lots of different kinds of macros are a sign of a healthy river.

Various minerals - the fine spices of a river include calcium bicarbonate, potassium, nitrates and phosphates. These ingredients help balance a rivers **pH**, provide building material for the shells of snails, **mussels**, clams and crayfish, help fish breathe more efficiently and act as natural fertilizers essential for aquatic plants.

a prime dumping ground for dead leaves, a surpassing reservoir of oxygen and calcium. It will then also, and thereby, be a good osprey stream, a favorite among otters, a salvation to dippers and kingfishers and bank swallows and heron, mergansers and Canada geese and water shrews, mink and muskrat and beaver. Not to

Aquatic plants and animals - aquatic plants provide cover for macros and small minnows. The aquatic plants and animals in the river, and those living along the river, provide food for each other in a complex **food web**. When all these various plants and animals die or excrete waste, they return essential nutrients that were borrowed so they could live back to the food web.

These are just the minimum ingredients needed for a healthy river. Now mind you, a river needs only natural ingredients, unnatural ingredients can have a bad effect on a river. David Quammen sums up what makes a healthy river when he talks about a trout stream. "A good trout stream must first be an excellent insect stream, a superior haven for algae and fungi and bacteria,

mention the occasional bear. And who knows but that, sometime, a human might want to drink."

If there are large numbers of many different species of plants and animals in the water, then we have a healthy river. Taking samples of these aquatic plants and animals is a means to monitor the **quality** of a river's waters.

Instructions:

1. Park staff will lead a brief discussion focusing on: macroinvertebrates (macros), what they are and why they are important; **metamorphosis**, what it is and how it is accomplished; and **indicator species**, what they are and how they are used to determine the health of a river. Park staff will also demonstrate how to use sampling equipment, and safety precautions that must be followed when using the equipment.

2. Have the students predict the **biotic index** for the Jacob's Fork River on their worksheet.

3. Briefly review the macroinvertebrate key. Be sure to point out that the key is not complete and the students should therefore key organisms as close as possible. For example, there are 186 dragonfly species in North Carolina, and the key only shows one dragonfly larva species, but the illustration should be close enough for the students to identify any dragonfly larva they find.

4. a. Divide the class into groups of five or less and distribute their equipment.

b. Instruct them on how to collect samples using kick nets.

c. Fill the white trays, aquariums and plastic jars half way with water.

d. Have the groups net their samples in the roped off area.

e. As soon as the samples are collected, have the groups move to the shore.

f. Drain the excess water from the nets.

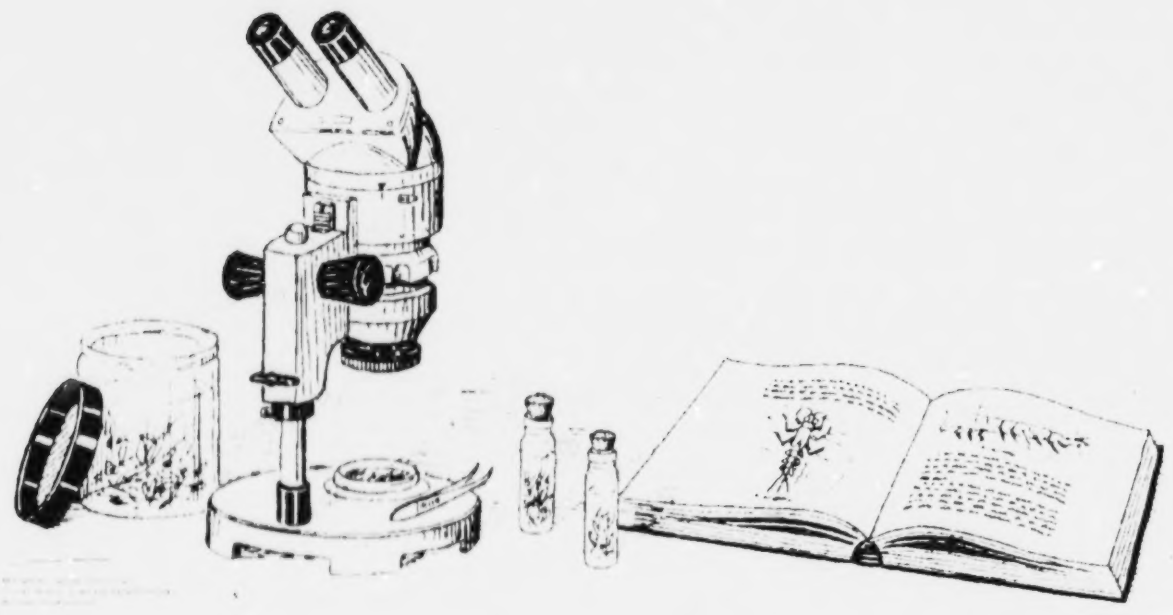
g. Have the students put on rubber gloves and search for organisms. (They may want to use a magnifying glass.)

h. Using tweezers or hands, carefully remove any organisms found and place them in the white tray, aquarium or plastic jar for observation and identification.

5. After collecting samples, each group should identify the aquatic macroinvertebrates they found using the "Key to Common Macroinvertebrates," field guides and dissecting scopes. Have them record their answers on the "Aquatic Sampling Data Sheet" and use their results to determine the Biotic Index Value (relative health) of the river.

The Biotic Index Value groups macros based upon how tolerant or sensitive they are to changes in water quality.

Group I macros are very intolerant of water pollution. The dominant presence of Group I species is an indication of good water quality. Group I is given an index value of 3. Group II macros are moderately tolerant to a reduction in water quality. They are given an index value of 2. Group III macros are tolerant to pollution. Their dominance indicates poor water quality. They are given an index value of 1.



The students can calculate the Biotic Index Value by using a simple formula:

(3 x no. of Group I)
(2 x no. of Group II)
+(1 x no. of Group III)
= **Biotic Index Value**

6. Return all organisms to the water after the research is done.

7. After the students have identified their specimens and determined the Biotic Index Value, park staff will lead a group discussion summarizing what they've learned, what they've identified from the river and the importance of indicator species and the Biotic Index Value.

8. Instruct the groups to gather and clean their equipment and return it where they found it.

9. Assemble the class and have each group present their findings. According to their study, what is the rating of the Jacob's Fork water quality? How does it compare to the students' initial prediction? If different, encourage students to explore reasons. Do different groups have different results? If so, explore reasons why. (Answers: improper collection/identification techniques by some; luck of the hunt, etc.)

Suggested Extensions:

1. Have the class compare their findings with other classes that have done this activity in the past by comparing worksheets. The worksheets can be different due to collection/identification techniques, luck of the hunt, weather, water level, season, etc.

2. Sample other streams and rivers in the area and compare the biotic index value with that of the Jacob's Fork River.

3. Take a hike to observe and experience High Shoals Falls.

Aquatic Sampling Worksheet

Name: _____ Date: _____

Location: _____

Methods used to sample: _____ Biotic Index Value: _____

A. Prediction of the river's Biotic Index: Excellent Good Fair Poor

Circle your choice. Why do you think the Jacob's Fork River will have this Biotic Index?

_____

_____

_____

B. Instructions:

1. Use the "Key to Common Macroinvertebrates" or "Pollution Tolerance of Macroinvertebrates" key to identify organisms.

2. Record the species of organisms found in the space below, using the key to classify them by their tolerance levels. (See example below.)

Group I	**Group II**	**Group III**
1._____	1._____	1._____
2._____	2._____	2._____
3._____	3._____	3._____
4._____	4._____	4._____
5._____	5._____	5._____
6._____	6._____	6._____
7._____	7._____	7._____
Total = _____	Total = _____	Total = _____

3. Calculate the Biotic Index Value by multiplying the number of species of organisms in each group by the index value for that group. Then, add the resulting three numbers to obtain the Biotic Index Value (see example below).

(3 x no. of species - Group I)
(2 x no. of species - Group II)
+ (1 x no. of species - Group III)
= **Biotic Index Value**

Cumulative Index Values	**Biotic Index Rating**
23 and above	Excellent
17 to 22	Good
11 to 16	Fair
10 to less	Poor

Group I	**Group II**	**Group III**
1. hellgrammite 4. caddisfly	*1. dragonfly*	*1. blackfly larva*
2. mayfly	*2. crayfish*	*2. freshwater worm*
3. snail	*3.*	*3.*
(3 x 4) +	**(2 x 2)** +	**(1 x 2) = 18**

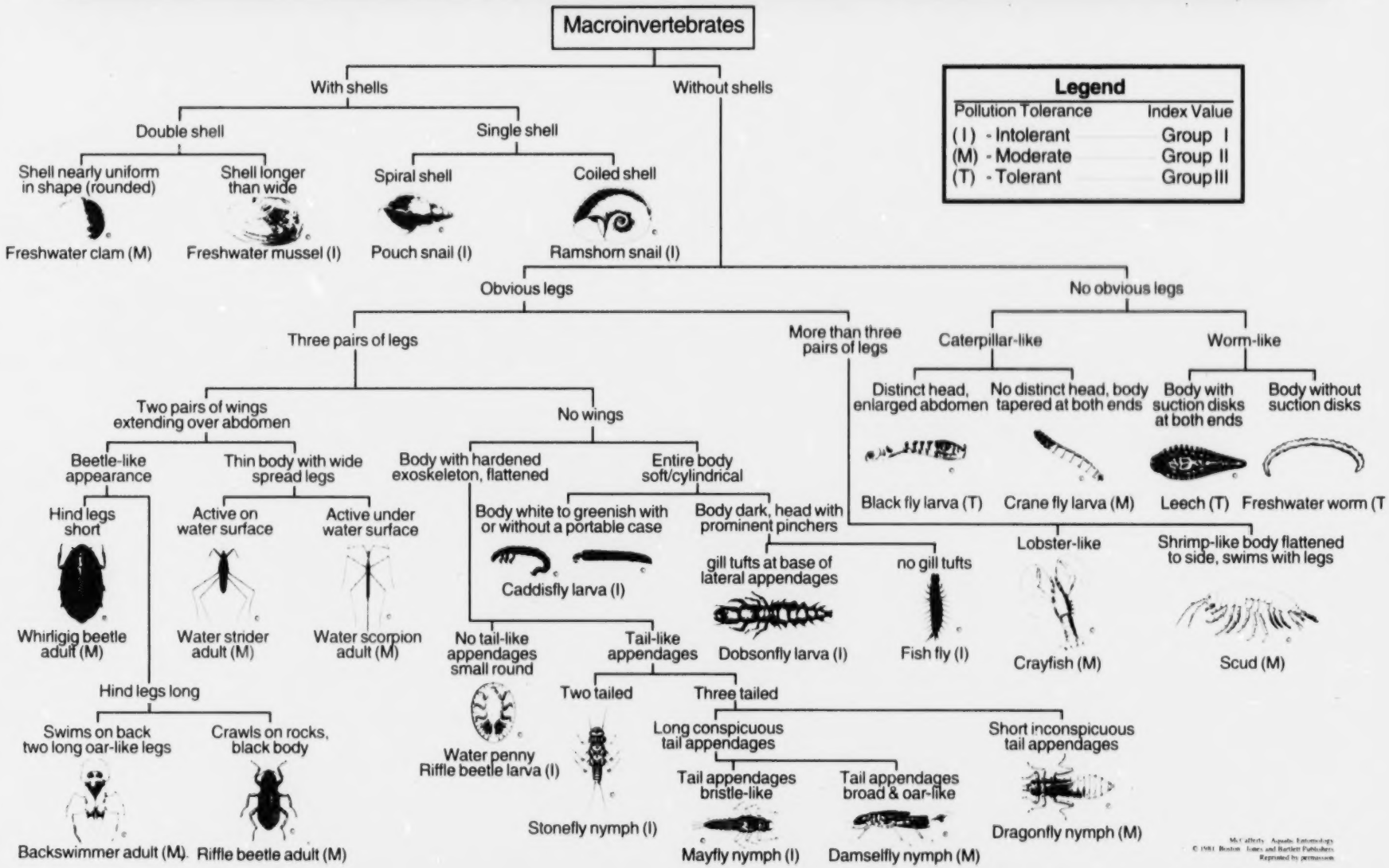
[18 is the biotic index value, which is a good rating according to the chart above].

Adapted from *A Field Manual for Water Quality Monitoring*, An Environmental Education Program for Schools by Mark K. Mitchell and William B. Stapp.

4. How would you describe the river's water quality based on its Biotic Index?

5. What do you think has caused or contributed to the water quality?

Key To Aquatic Macroinvertebrates
of the Jacob's Fork River



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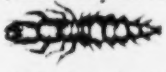
Pollution Tolerance of Macroinvertebrates key

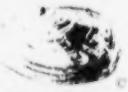
Group I - Index Value = 3
These macroinvertebrates can not tolerate pollution or changes in water quality. Their presence or dominance generally indicates good water quality.

mayfly nymph

Hellgrammite
(dobsonfly larva)



freshwater mussel



stonefly nymph

riffle beetle adult

right-handed pouch snail

water penny
(riffle beetle larva)

caddisfly larva

Group II - Index Value = 2
These macroinvertebrates can exist in a wide variety of water quality conditions.

dragonfly nymph

damselfly nymph

crayfish

freshwater clam

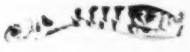
scud

whirligig beetle

water strider

Group III - Index Value = 1
These macroinvertebrates can exist in polluted water. Their dominance indicates poor water quality.

black fly larva



leech

freshwater worm

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Post-Visit Activity #1 — Caddisfly Creek

Curriculum Objectives:
Grade 4
- Communication Skills: listening, reading, vocabulary and viewing comprehension, study skills using environmental sources
- Guidance: evaluate the importance of familiar jobs, competency for interacting with others
- Science: living things–animals, interdependence of animals
- Social Studies: gather, organize and analyze information, draw conclusions, use maps, participate effectively in groups

Grade 5
- Communication Skills: listening and visual comprehension, study skills
- Guidance: competency and skill for interacting with others
- Science: earth science, environment
- Social Science: organize and analyze information, draw conclusions; use maps, participate effectively in groups

Location: Classroom

Group Size: One class

Estimated Time:
One to three 45 minute periods

Appropriate Season: Any

Credits:
This activity was adapted from the Aquatic Project WILD activity, "Dragonfly Pond."

Materials:
Provided by educator:
Per student: one copy of Student's Information, and "Special Species" fact sheet
Per group: scissors, masking tape, paste or glue, paper, one copy each of "Land Use" cut-outs, "Caddisfly Creek" maps

Major Concepts:
- Human impact on watersheds
- Water quality
- Land use planning and its effect on a river
- Preservation of natural areas
- Resource management

Objectives:
- Evaluate the effects of different imaginary land uses on "Caddisfly Creek."
- Discuss and evaluate the effects of three different land use methods on the river.
- List three ways people can change their lifestyles to decrease damaging effects on water quality and on the Jacob's Fork River.
- List three ways local businesses, industries and communities could change the way they "do business" to decrease damaging effects on water quality and on the river.
- Assess the importance of state parks in protecting the quality of our water.

Educator's Information:

The major purpose of this activity is to encourage the students to wrestle with potentially conflicting land use concerns in an effort to preserve a creek and its **watershed**. After the students reach an agreement about local land uses, they will consider how their decisions affect the **aquatic** resources downstream. End the activity with a discussion of the idea that the earth's aquatic resources are all interconnected, and all land use activities impact other things.

Student's Information

Every human use of land in the Jacob's Fork River **watershed** has a positive or negative effect, not only on the Jacob's Fork River, but also on the water, wildlife and people downstream to the Atlantic Ocean. What we do with land is a reflection of our priorities, **lifestyles** and conservation ethic. The search for a modern day "good life" and all of its conveniences produces mixed results for plants, animals, water quality and people in the Jacob's Fork River watershed. Some people see our natural resources as little more than raw material for human use. Others believe a natural environment should always be preserved without being damaged by humans and their lifestyles. Still others believe there should be a balance between development and protection of our resources. Very real differences of opinion on these issues exist between well meaning people.

Given the extensive impact humans have on the earth, a major challenge we now face is how to act more responsibly. We must develop the awareness, knowledge, skills and commitment necessary to encourage others to act more responsibly when it comes to **stewardship** of watersheds and the remaining natural areas. We must work to restore areas where human disturbance has existed for centuries.

At the core of land use issues is the concept of growth. Growth in natural systems has inherent limitations, imposed by a dynamic balance of energy between all parts of the system. Energy in natural systems is translated into food, water, shelter, space and continued survival. This means that the vitality of natural systems is expressed by their ability to be self-regulating. This capacity for self-regulation makes it possible for all natural members of an **ecosystem** to live in harmony. All life forms of any ecosystem must be considered. The **macroinvertebrates** in the water are just as necessary to a **habitat** as the plants and fish. It is this natural, dynamic balance, with all its inherent and essential parts, that much of human land use has tended to disturb. Human activities often go beyond the natural limits of an ecosystem.

The South Mountains area is growing rapidly. Homeowners and industry are spreading out from our cities, seeking undeveloped land to use. They help our local economy by creating new jobs. This development is good, but it sometimes conflicts with protecting the river's water **quality** and the plants and animals that live in and around the river. This is where different people have different ideas about how to best use the land and water from Jacob's Fork River and still ensure the river is clean.

Think back to your visit to South Mountains State Park. We know that Jacob's Fork River provides water which is used in a variety of ways, including water for drinking, for industry and for sewage treatment for many towns and cities. Many different forms of recreation are enjoyed on and around the Jacob's Fork River. The river is also home to a wide variety of plants and animals.

Humans have the ability to import energy sources that allow a system to exceed its natural limits - or to remove energy sources that are necessary for a system to stay in balance. For example, people can dam rivers to make lakes to provide power and **irrigation**. Water from Jacob's Fork River can be used in factories, mills and other industries that need large amounts of water to produce certain products. All of these activities could affect life in the river.

So how do we make land use decisions that will benefit the local economy and still protect our natural resources? The following activity is designed to give you a taste for how difficult the decision making process can be.

Instructions:

1. Prepare copies of the "Special Species" Fact Sheet, the "Caddisfly Creek" map, the "Land Use" cutouts and the Student's Information ahead of time. Explain the activity. Tell the students they will be responsible for arranging the pattern of land use along Caddisfly Creek in such a way as to minimize the impact on the river and protect this resource. Remind them that some of these land uses might be conflicting and therefore they will have to make some very tough management decisions. Pass out the Student's Information and have the students read it.

2. Divide the class into groups of three to five, with each group representing one of the interest groups. Students will stay in these groups until the end of the activity. Interest groups are:

A. Farmers - want to clear and use land to produce food, livestock and lumber for profit.

B. Highway department - wants to build highways to provide access to the area for fire, police and emergency medical services.

C. Permanent residents - want development, but not so much that their homes are affected by noise, traffic, **pollution**, etc.

D. Business interests - want to use the land for commerce and development for profit (home builders, small business, etc.)

E. Public services - want to build and operate a **waste water treatment plant** in the area.

F. Division of State Parks - wants to preserve and protect the watershed for plants and wildlife, recreation, drinking water, historical sites and as an "outdoor classroom" to teach visitors about nature and its importance.

G. Adopt-a-State Park group - wants to help preserve additional land for the area park

3. Pass out the "Special Species", "Caddisfly Creek" and "Land Use"sheets. Have the students cut out the land use pieces and place them along the river's watershed. Tell them all of the land use pieces must be used, and none may be placed within the state park. The pieces may be cut smaller, but must not overlap. The students may also create land uses of their own.

Point out to the students that there are two species of plants and three species of animals on the map where they might naturally occur. Most of these species are either state protected or have special habitat requirements. The purpose of placing these on the map is to make the decisions more realistic. Information on these species is on the "Special Species" Fact Sheet.

4. Once the students have cut out the necessary materials and are ready to begin the process of making land use decisions, have them create a list of pros and cons for each land use. Guide the class discussion so that they consider the consequences of each land use. Record these on the chalkboard.

The following are a few examples:

Natural Areas

PRO

- Provide outdoor recreation opportunities such as hiking and nature study.
- Provide protection of natural communities and habitats, the watershed and **native** species.
- Bring tourist dollars into local economy as park visitors spend money at local businesses.

CON

- Remove land for possible development (i.e. agriculture, forestry, industry, etc.).
- Remove land from the tax base.

Farms

PRO

- Produce food.
- Provide jobs.
- Produce lumber and other wood products.

CON

- Increase **soil erosion**.
- Use chemicals (pesticides, herbicides, etc.) that may harm people and the environment.
- Use fertilizers and produce animal wastes which increase the nutrient load in the aquatic systems upsetting the balance of the ecosystem.
- Sometimes destroy stream buffers, wetlands or other natural areas for fields or to harvest lumber.

Homes

PRO

- Provide human shelter.
- Provide jobs in construction and maintenance.

CON

- Generate waste, sewage and other pollution (i.e. used oil, lawn chemicals, etc.).
- Contribute to loss of natural areas (i.e. development and energy needs).

Waste Water Treatment Plant

PRO

- Provides for more development.
- Provides treatment for waste water.
- Provides jobs in construction, maintenance and operation of the plant.

CON

- Discharges **effluent** containing chlorine and nutrients into the watershed.
- Contributes to loss of natural areas (i.e. construction, maintenance, and energy needs).
- Increases **runoff** from **impervious surfaces** (parking lots, roofs, etc.) resulting from increased development.

Restaurant

PRO

- Provides jobs.

CON

- Contributes to loss of natural areas (i.e. energy needs).
- Increases runoff from impervious surfaces (parking lots, roofs, etc.).
- Contributes large amounts of waste products.

Highways

PRO

- Provide access to areas for emergency medical services.
- Provide jobs in construction and maintenance of roads.

CON

- Contribute to loss of natural areas (i.e. construction, maintenance and energy needs).
- Increase runoff due to impervious surfaces.
- During construction, increase soil erosion.
- Disrupt natural water flow and animal migration patterns.
- During maintenance of roadsides, contribute to the use of herbicides that may harm people and the environment.
- Can be hazardous for people and other animals (wildlife is attracted to the garbage thrown along the roadside).

Laundromat

PRO

- Provides jobs in construction and operation.

CON

- Contributes to loss of natural areas (i.e. energy needs).
- May introduce significant amounts of polluted water into watershed.
- Increases runoff due to impervious surfaces (parking lots, roofs, etc.).

Gas Station

PRO

- Provides jobs in construction, maintenance and operation.

CON

- Contributes to loss of natural areas (i.e. energy needs).
- Runoff may contain pollutants such as gas and oil.
- Increases runoff due to impervious surfaces (parking lots, roofs, etc.).
- Can contaminate **groundwater** if underground storage tanks are leaking.

5. Have the students work in their teams long enough to begin serious debate over the land use decisions before them. Remind them that no land use can be excluded, the river corridor must be preserved, and the special species must be protected. Everyone in the group must reach consensus for each land use. Offer an opposing viewpoint should they need it. Have them lightly fasten the cut-outs to the map by placing small loops of tape on the back of each cut-out. This will allow the students to change their minds before the cut-outs are permanently placed on the map.

6. Give the students time to come up with what they believe to be the best possible land use plan under the circumstances. (Be sensitive to their frustrations.) Display all the final land use plans in the classroom and analyze and discuss the merits of each of the approaches. Point out that although their solutions may not be perfect, each one, in some way, minimizes damage to the Caddisfly Creek's watershed. Be sure to remind the students that all of the pollutants dumped into the river's watershed eventually flow downstream.

7. Ask the students to brainstorm possible problems that could be faced within each of the aquatic systems of the Jacob's Fork River, Henry Fork River and Catawba River as a result of the human activities around the Jacob's Fork River. Make inferences and predictions about the potential consequences of these activities. For instance, you could emphasize the wastewater from a Laundromat. How will it be treated? Where? By whom? Where will it go? With what effects?

8. Ask the students to look again at all of the land uses in this activity. If they had been considering any of them as inherently bad, have them consider a different question. What could the people who are in charge of these various businesses do to minimize the damage to Caddisfly Creek? Have the activity end with a positive emphasis on solutions rather than problems and write these solutions on the board.

9. Have the students create a list of things that they personally can do to reduce the potentially damaging effects of their lifestyles on the "downstream" areas. If possible, invite them to report on their progress throughout the school year in carrying out these new practices. Consider with them the idea that all of the waters of the earth are interconnected and are in fact part of a single "Caddisfly Creek" watershed.

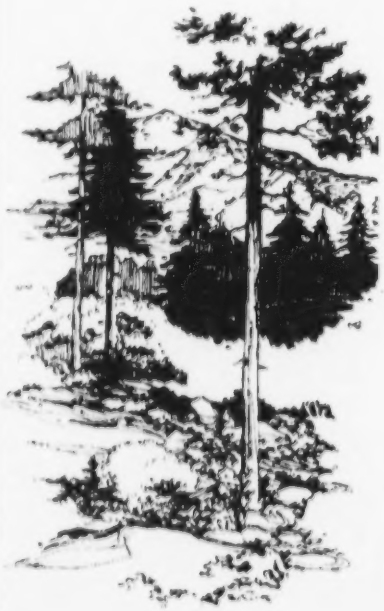
Suggested Extensions:

1. Organize a "Stream Watch" group in your community. Stream Watch groups "adopt" a waterway, or portion of one, and act on its behalf. They take care of the waterway by monitoring water quality, providing educational programs, removing litter, etc. For more information on Stream Watch, contact:

Stream Watch Coordinator
Division of Water Resources
NC Department of
Environment, Health and
Natural Resources
P.O. Box 27687
Raleigh, NC 27611
(919) 733-4064

2. Collect newspaper articles for local water related and land use issues as a current events activity.

3. Learn more about environmental impact statements. Try to obtain actual statements about natural areas in your region from local and state government offices. See what concerns are addressed in these documents.



4. Learn more about private organizations that work to protect natural resources. Examples include:

The North Carolina
Environmental Defense Fund
128 E. Hargett St., Suite #202
Raleigh, NC 27601

The North Carolina
Nature Conservancy
Carr Mill Mall, Suite 223
Carrboro, NC 27510

The Catawba Lands
Conservancy
1614 Fountain View
Charlotte, NC 28203

5. Find out about zoning laws and land use regulations in your area by contacting the following:

City/County:

Director of City/County
Planning/Zoning

State:

Division of Environmental
Management
PO Box 27687
Raleigh, NC 27611

Would the plan your group proposed for the park river watershed be allowed in your community?

6. Send a representative sample of the students' land use plans to the park. (We would appreciate the feedback.)

7. Write to the Burke County Planning and Zoning Board about any concerns you have with the water quality of the Jacob's Fork, Henry and Catawba rivers' watersheds.

Planning and Zoning Board
P. O. Box 219
Morganton, NC 28655
(704) 433-4035

Special Species Fact Sheet

Land use around the Jacob's Fork River is very important because it affects the kinds of plants and animals you see at South Mountains State Park. Listed below are some special species at the park which need certain conditions to thrive.

McCafferty. Aquatic Entomology
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Caddisfly

These insects need a healthy aquatic environment to live in and are quite common in the park's pristine streams. They provide food for the trout and other aquatic macroinvertebrates that live there. The caddisfly larvae construct cases of twigs, leaves, sand, pebbles and other debris. The individual species are identified by the materials they use in their larval cases.

Ginseng

A medicinal plant that has been over-collected to sell in this country and overseas. Ginseng is now uncommon in the mountains where it was once plentiful. This plant has been used for centuries for its reputed medicinal powers.

Copperhead

One of only two poisonous snake species found in the park. Copperheads are nocturnal during the hot summer months. They crawl down from the woods to the grassy fields near creeks to hunt for small rodents in late summer. Copperheads are considered non-aggressive and only bite if provoked.

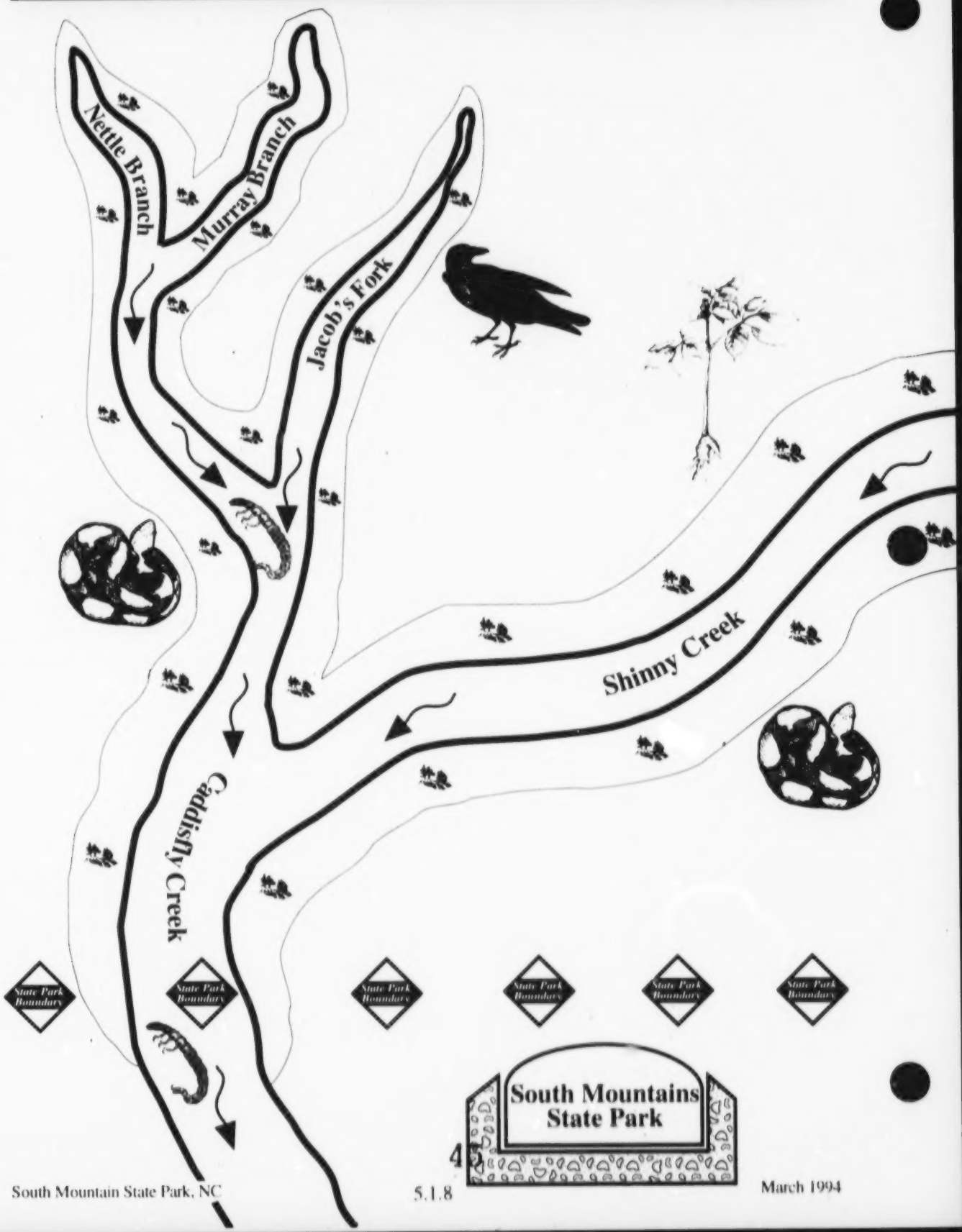
Yellow Lady's Slipper Orchid

An uncommon wildflower, requiring soils that are close to a neutral pH (most soils in our region are acidic) and a mature tree canopy to give it partial shade. It takes a minimum of 15 years for this orchid to grow from a seed to a flowering plant.

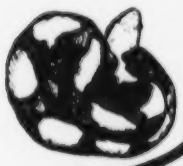
Common Raven

A rare native bird found in Western North Carolina. Nesting sites are uncommon due to a lack of remoteness and privacy which the ravens seem to require. For several consecutive years, they have successfully raised young on a cliff near High Shoals Falls, located in the park. Their call is a hoarse, croaking sound.

Caddisfly Creek Map



Map con't



Henry Fork River

S. Fork Catawba River

Legend

State Park boundary
(no development beyond this line)

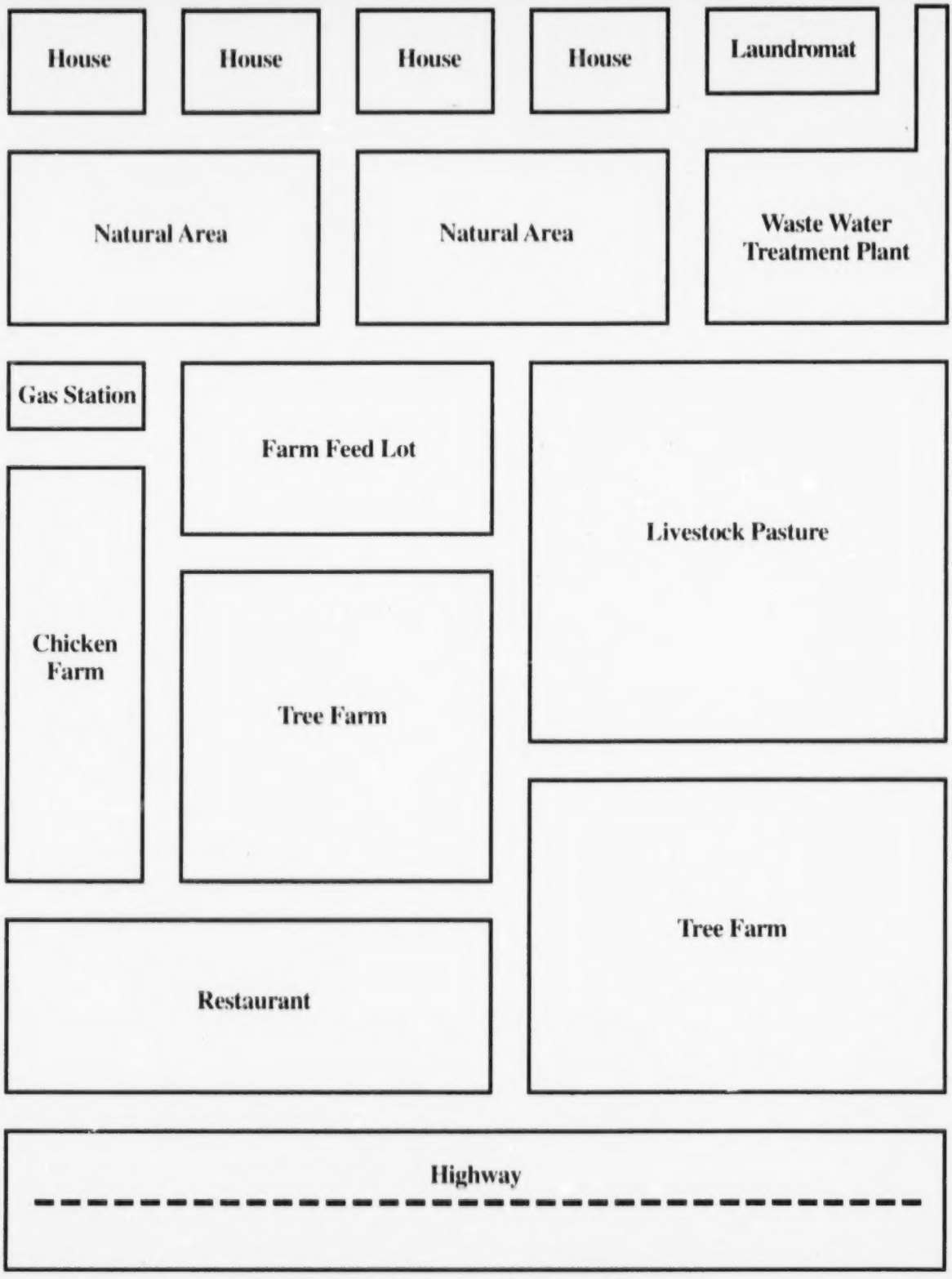
Direction of water flow

Natural area & river corridors

North Carolina / South Carolina Boundary

Lake Wylie

Land Use Cutouts



VOCABULARY

Acid - Having a pH less than 7; the chemical state of water or other substance in which the hydrogen (H+) ions exceed the hydroxyl (OH-) ions. For example, a car's battery acid has a pH of 1. See pH.

Adaptation - A change in the structure or activity of an organism that produces a better adjustment to its environment, thus enhancing its ability to survive and reproduce. For example, the flattened, oval shape of the larva of the riffle beetle (called a water penny) is an adaptation that helps it cling to the surface of rocks in swift waters.

Algae - Simple, one-celled or many-celled plants, capable of photosynthesis. They are usually aquatic and have no true root, stem or leaf.

Anatomy - The branch of biology that deals with the structure of plants and animals.

Aquatic - Living or growing in water.

Base - Having a pH greater then 7; the chemical state of water or other substance in which the hydroxyl (OH-) ions exceed the hydrogen (H+) ions. For example, soap has a pH of 10. See pH.

Biology - The science that deals with the origin, history, physical characteristics, life processes and habits of plants and animals

Biotic index - An indicator of the health of a habitat. It is based on the tolerance or sensitivity of plants and animals to changes in environmental quality and is calculated using a simple formula. The health of a stream is determined by the number of individual organisms plus the diversity of species found there.

Classification - The grouping of organisms into categories based on shared characteristics or traits. For example, any animal that has feathers is considered a bird and is placed in the Class Aves. Furthermore, if the bird had its eyes in front rather than on the side of its head, it is a member of the Order Strigiformes (the owls).

Detritus - Dead organic matter, such as fallen leaves, twigs, and other plant and animal material, which exists in any ecosystem.

Dichotomous - Divided into two parts, groups or classes, such as a dichotomous key. Using a dichotomous key, one can identify an unknown organism by following the one branch of each pair that best describes the organism.

Distribution - The act of scattering or spreading out; the geographic range of an organism.

Dissolved oxygen (DO) - The amount of oxygen gas molecules dissolved in water. Fish and other aquatic animals depend on DO for respiration.

Diversity - In the context of these activities, it refers to a variety of species of plants and animals.

Ecology - The science of the relationships between organisms and their environments.

Ecosystem - Plants, animals and their physical surroundings which interact with environmental conditions, such as temperature and rainfall, forming an interdependent system.

Effluent - A liquid flowing out. The outflow of a sewer, septic tank, etc.

Erosion - The process of soil and rock particles being moved from one location to another by natural processes such as water, wind, gravity, or other forces or processes.

Food Chain - The transfer of energy and material through a series of organisms as each one is fed upon by the next. For example: Detritus > caddisfly larvae > sunfish > otter.

Food Web - The interlocking pattern of food chains which exist in an ecosystem.

Genus - In biology, a taxonomic category ranking below a family and above a species, used in grouping similar living things, either alone or followed by a Latin adjective or epithet, to form the name of an organism. It is the main subdivision of a family.

Groundwater - Water that fills the spaces between rocks and soil particles underground. Groundwater is replenished when rainwater trickles through the soil. Surface water, such as lakes and rivers, is often replenished by groundwater.

Habitat - The environmental conditions of an area where a plant or animal naturally grows or lives; its environment.

Healthy - In the context of these activities, it refers to the cleanliness or purity of the stream water.

Impervious surface - A surface that doesn't absorb water such as a paved parking lot.

Indicator species - An organism whose presence or absence in a particular environment can be used to determine the health of that particular environment.

Insect - Any animal in the Class Insecta. It has a head, thorax, abdomen, and three pairs of legs on the thorax. An adult usually has one or two pairs of wings attached to the thorax as well.

Irrigation - The pumping of water from ponds, lakes, or rivers through pipes or canals to supply crops or livestock with water during dry periods of weather.

Key - In the context of these activities, it is an ordered list of significant characteristics of a group of organisms used to identify unknown species.

Larva - (larvae, plural) The immature form of an animal that changes structurally when it becomes an adult, usually by complex metamorphosis.

Lifestyle - A way of life, including attitudes, values and priorities.

Macroinvertebrate - Macro means "large," invertebrate means "without a backbone." An invertebrate usually large enough to be seen without the aid of magnification.

Metamorphosis - Meta means "change," morphe means "form." A change in form, structure or function as a result of development. A physical transformation undergone by various animals during development from the larval stage to the adult form. For example, through metamorphosis, a hellgrammite (larval form) becomes a Dobsonfly (adult form). The change from a tadpole (larval form) to a frog (adult form) is another example of metamorphosis.

Mussel - Any of the various freshwater or saltwater bivalves (meaning the two shells), held together by a strong muscle.

Native - Refers to a plant or animal originally found in a certain area; not foreign.

Nymph - The young of an insect that undergoes incomplete metamorphosis, differing from the adult primarily in size and structural proportions (i.e. wings).

Organism - A living thing. Examples include plants and animals.

Outstanding Resource Water - A legal designation given to very pure, unpolluted stream water. Examples are Jacob's Fork River and Shinny Creek, located within South Mountains State Park.

pH - potential of hydrogen. A measure that indicates the relative acidity or alkalinity of a substance. The pH scale is a logarithmic scale ranging from 0 (most acidic) to 14 (most basic), with a pH of 7 being neutral.

Photosynthesis - The chemical process carried on by green plants in which the cells that contain chlorophyll use light energy to produce glucose (a plant food) from carbon dioxide and water; oxygen is released as a by-product. See Respiration.

Pollution - A human-caused change in the physical, chemical, or biological conditions of the environment that creates an undesirable effect on living things.

Quality - A degree of excellence which a thing possesses.

Runoff - Rain, melted snow and other materials that drain or flow off surfaces such as city streets, roofs, suburban lawns and agricultural land.

Sediment - Deposits of soil or organic matter which were suspended in water and then settled to the bottom. It is often deposited in the water by runoff.

Silt - A sedimentary material consisting of fine mineral particles intermediate in size between sand and clay.

Soil - A collection of organic and inorganic particles, mainly composed of clay, silt, sand and gravel.
clay - less than 1/256 of a millimeter (mm) in diameter
silt - between 1/256 and 1/16 of a mm in diameter
sand - between 1/16 and 2 mm in diameter
gravel - over 2 mm in diameter

Species - The taxonomic category located after genus which consists of organisms that have a high degree of similarity and can mate and produce fertile offspring.

Stewardship - The act of people taking responsibility for the protection and preservation of a clean and healthy environment.

Taxonomy - A branch of biology dealing with arranging and classifying organisms into natural, related groups based on some factor common to each, such as structure, embryology, biochemistry, etc.

Tributary - A stream or river flowing into a larger stream, river or lake. The Jacob's Fork River is a tributary of the Catawba River.

Waste Water Treatment Plant - Facility where water from households, businesses and industrial are treated with chemicals, processed to remove harmful bacteria and chemicals.

Water - A transparent, odorless, tasteless liquid compound of hydrogen and oxygen (H_2O) which occurs on the earth's surface as oceans, lakes, rivers, etc.

Water Quality - A way of determining or measuring certain characteristics of water.

Watershed - All of the land area that drains directly or indirectly into a creek, river, lake or other body of water.

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SCHEDULING WORKSHEET

For office use only:
Date request received_____ Request received by_____

1) Name of group (school) _____

2) Contact person _____ _____
name phone (work) (home)

_____
address

3) Day/date/time of requested program _____

4) Program desired and program length _____

5) Meeting place _____

6) Time of arrival at park _____ Time of departure from park _____

7) Number of students _____ Age range (grade) _____
(Note: A maximum of 30 participants is recommended.)

8) Number of chaperones _____
(Note: One adult for every 10 students is recommended.)

9) Areas of special emphasis _____

10) Special considerations of group (e.g. allergies, health concerns, physical limitations)_____
_____

11) Have you or your group participated in park programs before? If yes, please indicate previous programs attended: _____
_____

12) Are parental permission forms required? _____ If yes, please use the Parental Permission form on page 9.2.

I, _____, have read the entire Environmental Education Learning Experience and understand and agree to all the conditions within it.

Return to: South Mountains State Park
Route 1, Box 206-C
Connell Springs, NC 28612

PARENTAL PERMISSION FORM

Dear Parent:

Your child will soon be involved in an exciting learning adventure - an environmental education experience at **South Mountains State Park**. Studies have shown that such "hands-on" learning programs improve children's attitudes and performance in a broad range of school subjects.

In order to make your child's visit to "nature's classroom" as safe as possible we ask that you provide the following information and sign at the bottom. Please note that insects, poison ivy and other potential risks are a natural part of any outdoor setting. We advise that children bring appropriate clothing (long pants, rain gear, sturdy shoes) for their planned activities.

Child's name _____

Does your child:

- Have an allergy to bee stings or insect bites?_____
  If so, please have them bring their medication and stress that they, or the group leader, be able to administer it.

- Have other allergies? _____

- Have any other health problems we should be aware of?_____
  _____

- In case of an emergency, I give permission for my child to be treated by the attending physician. I understand that I would be notified as soon as possible.

_____ _____
Parent's signature date

Parent's name _____ Home phone _____
(please print) Work phone _____

Family Physician's name _____ phone _____

Alternate Emergency Contact

Name_____ phone _____

NORTH CAROLINA PARKS & RECREATION
PROGRAM EVALUATION

Please take a few moments to evaluate the program(s) you received. This will help us improve our service to you in the future.

1. Program title(s) _____ Date _____
   Program leader(s) _____

2. What part of the program(s) did you find the most interesting and useful? _____
   _____

3. What part(s) did you find the least interesting and useful?_____
   _____

4. What can we do to improve the program(s)?_____
   _____
   _____

5. General comments _____
   _____
   _____
   _____

LEADERS OF SCHOOL GROUPS AND OTHER ORGANIZED YOUTH GROUPS
PLEASE ANSWER THESE ADDITIONAL QUESTIONS:

6. Group (school) name _____

7. Did the program(s) meet the stated objectives or curriculum needs? _____
   If not, why? _____
   _____

Please return the completed form to park staff. Thank you.

South Mountains State Park
Route 1, Box 206-C
Connelly Springs, NC 28612